

# Construction of North America's Largest CoMag Ballasted Flocculation Process for Phosphorus Removal

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NEWEA Annual Conference

January 25, 2022



# Project Team Members

## Engineering

- Kleinfelder
- AECOM

## Owner

- City of Pittsfield

MassDEP

## General Contractor

- Methuen Construction



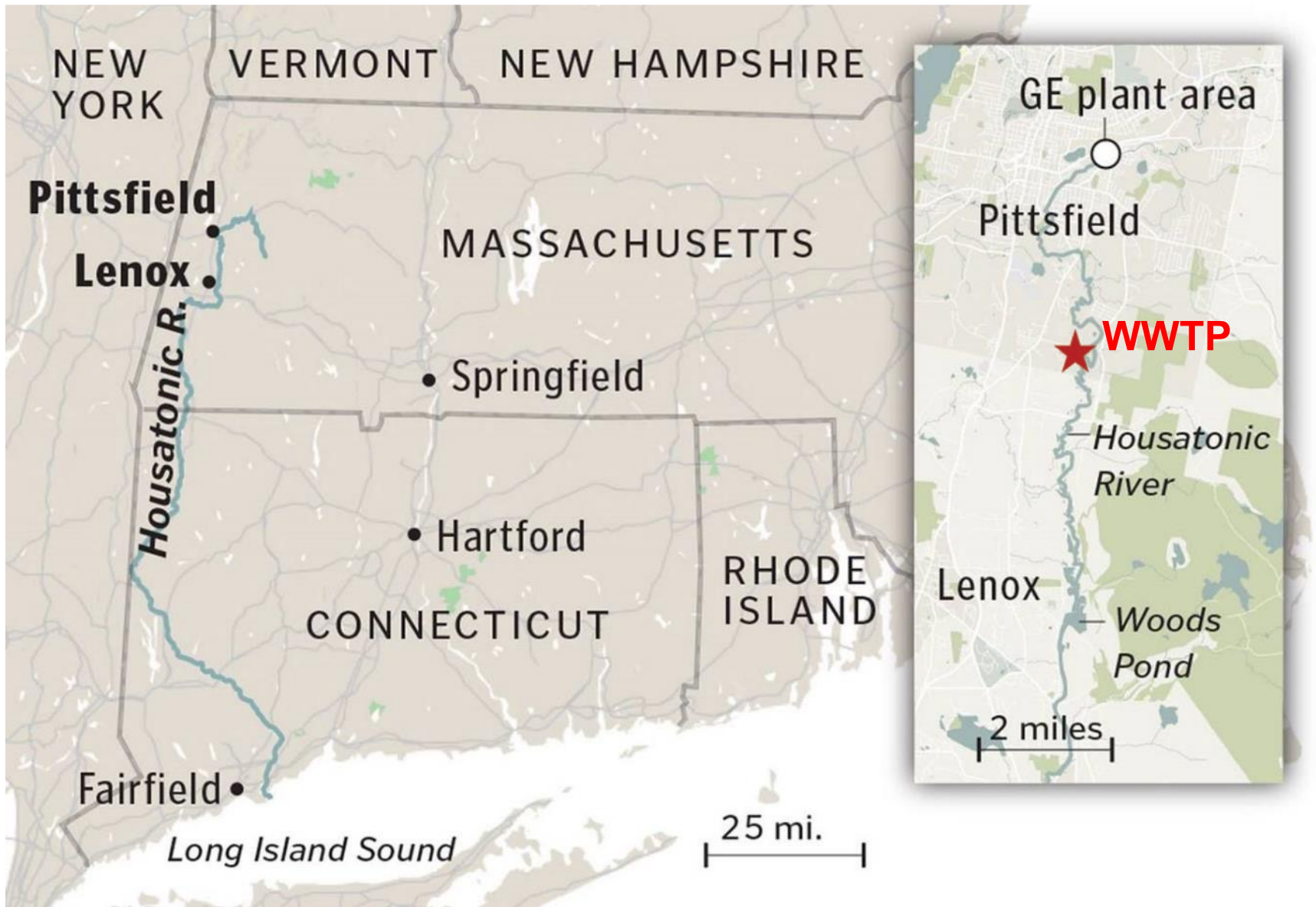
# OUTLINE

- **Background**
- **Project Components**
- **Construction**
- **Summary / Lessons Learned**



# Background

# Location



# Pittsfield WWTP

**Design Flow: 17 MGD**

**Peak Flow: 30 MGD**

**Average Flow: 12 MGD**

1. Screening & Grit Removal
2. Primary Settling
3. Trickling Filtration
4. Activated Sludge Treatment
5. Hypochlorite Disinfection
6. Anaerobic Digestion
7. Thickening (GBTs) & Dewatering (BFPs)



# INTRODUCTION - 2008 NPDES Permit

Parameter	Unit	Discharge Limitation			Effluent (2019)
		Average Monthly	Average Weekly	Maximum Daily	
cBOD <sub>5</sub>	mg/L	10	10	Report	1.3
TSS	mg/L	20	25	Report	6.8
Ammonia (April 1 – 30)	mg/L	10	10	15	0.10
(May 1 – 31)		5.0	5.0	8.0	0.08
(June 1 – Sept. 30)		1.0	1.0	1.5	0.12
(Oct. 1 – March 31)		Report	-	Report	0.10



# INTRODUCTION - 2008 NPDES Permit

- New effluent limits for TP and Aluminum
- City appealed and lost
- Permit Required:
  - Alternatives analysis
  - Implementation schedule
  - Pilot testing

Parameter	Unit	Discharge Limitation		Effluent (2019)
		Average Monthly	Maximum Daily	
<b>Phosphorus, Total*</b> (April 1 <sup>st</sup> – Oct. 31 <sup>st</sup> ) (Nov. 1 <sup>st</sup> – March 31 <sup>st</sup> )	<i>mg/L</i>	<b>0.1</b>	<b>Report</b>	<b>0.84</b>
	<i>mg/L</i>	<b>1.0</b>	<b>--</b>	<b>0.55</b>
<b>Ortho-phosphorus, dissolved</b> (Nov. 1 <sup>st</sup> – March 31 <sup>st</sup> )	<i>mg/L</i>	<b>Report</b>	<b>--</b>	<b>0.36</b>
<b>Total Nitrogen</b>	<i>mg/L</i>	<b>Report</b>	<b>Report</b>	<b>13.9</b>
<b>Total Aluminum</b>	<i>μg/L</i>	<b>171</b>	<b>Report</b>	<b>323</b>

\*60 day rolling average



# INTRODUCTION - Technologies

- Most of the Aluminum comes from Water Treatment Plant
- Aluminum removal at WWTP was the most cost-effective alternative
- The Pilot testing showed that Ballasted Flocculation was a viable option

# Ballasted Flocculation

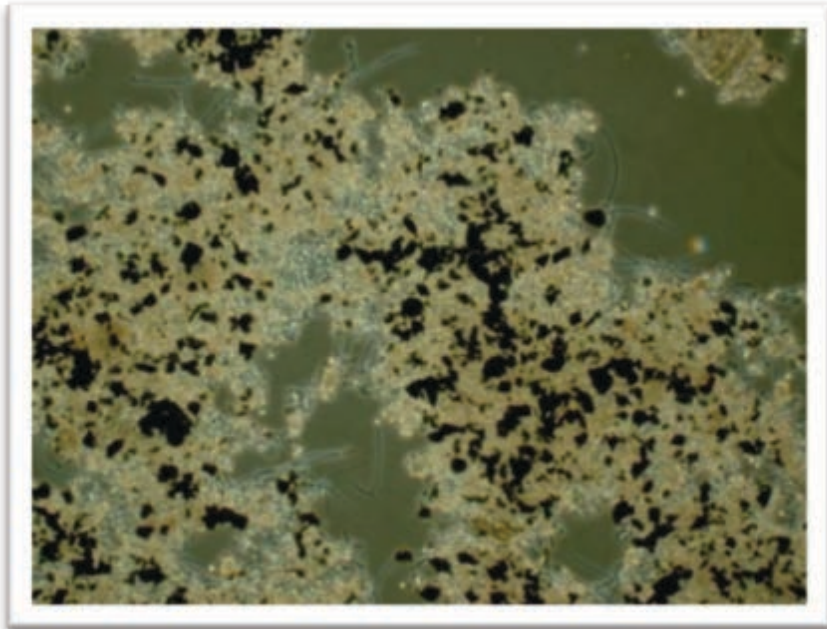
- High-Rate Clarification based on selection process
- Adds ballast to floc
- Ballast – dense particle
- Uses sedimentation to remove solids



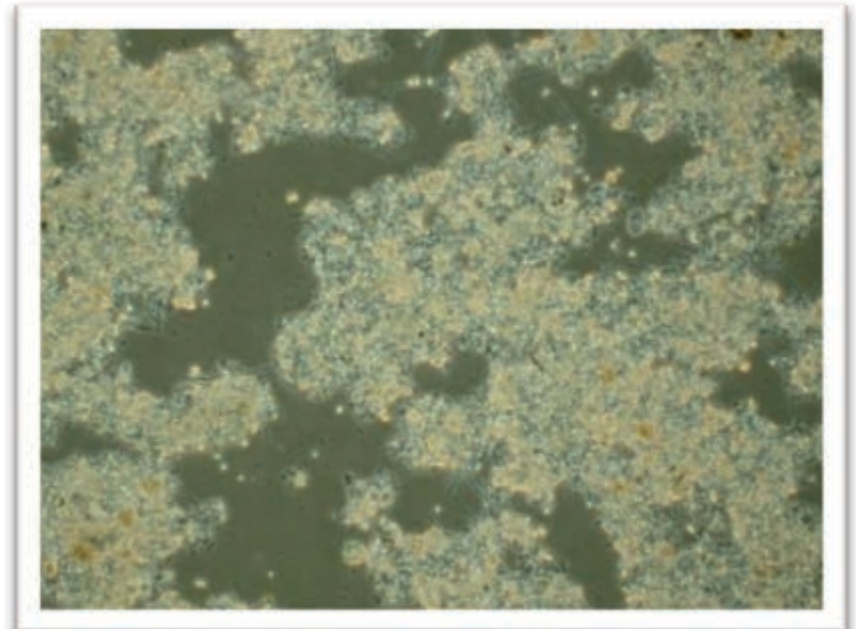
[http://www.ncsafewater.org/Pics/Training/AnnualConference/AC10TechnicalIPapers/AC10\\_Wastewater/WW\\_T.PM\\_04.15\\_Philbrook.pdf](http://www.ncsafewater.org/Pics/Training/AnnualConference/AC10TechnicalIPapers/AC10_Wastewater/WW_T.PM_04.15_Philbrook.pdf)

# Ballasted Flocculation Selected

- CoMag ballasted flocculation technology met the tertiary treatment goals for TP and Al removal with PAC coagulant.



Ballasted flocs settle rapidly and reliably

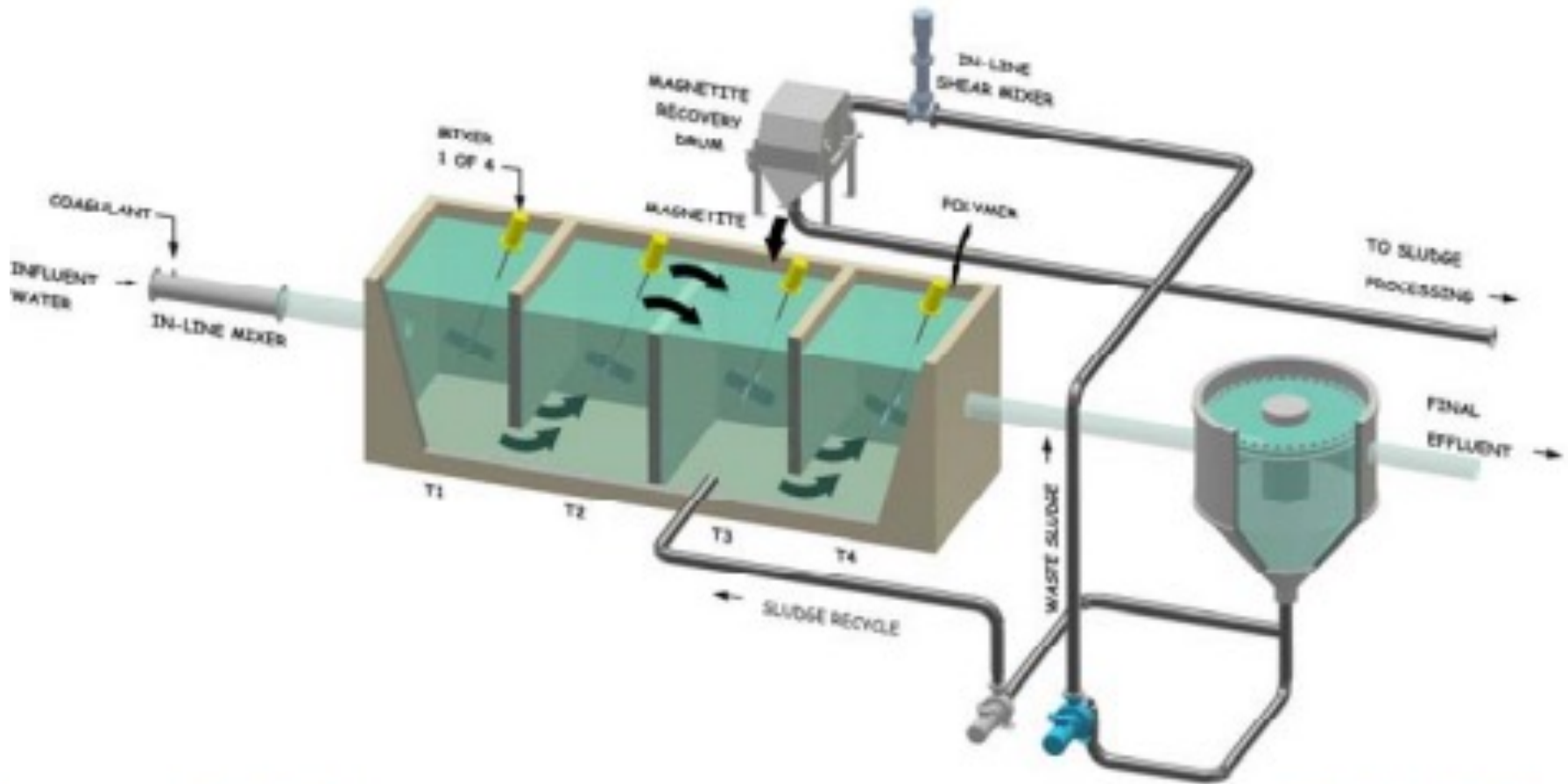


Flocs with no ballast settle slowly

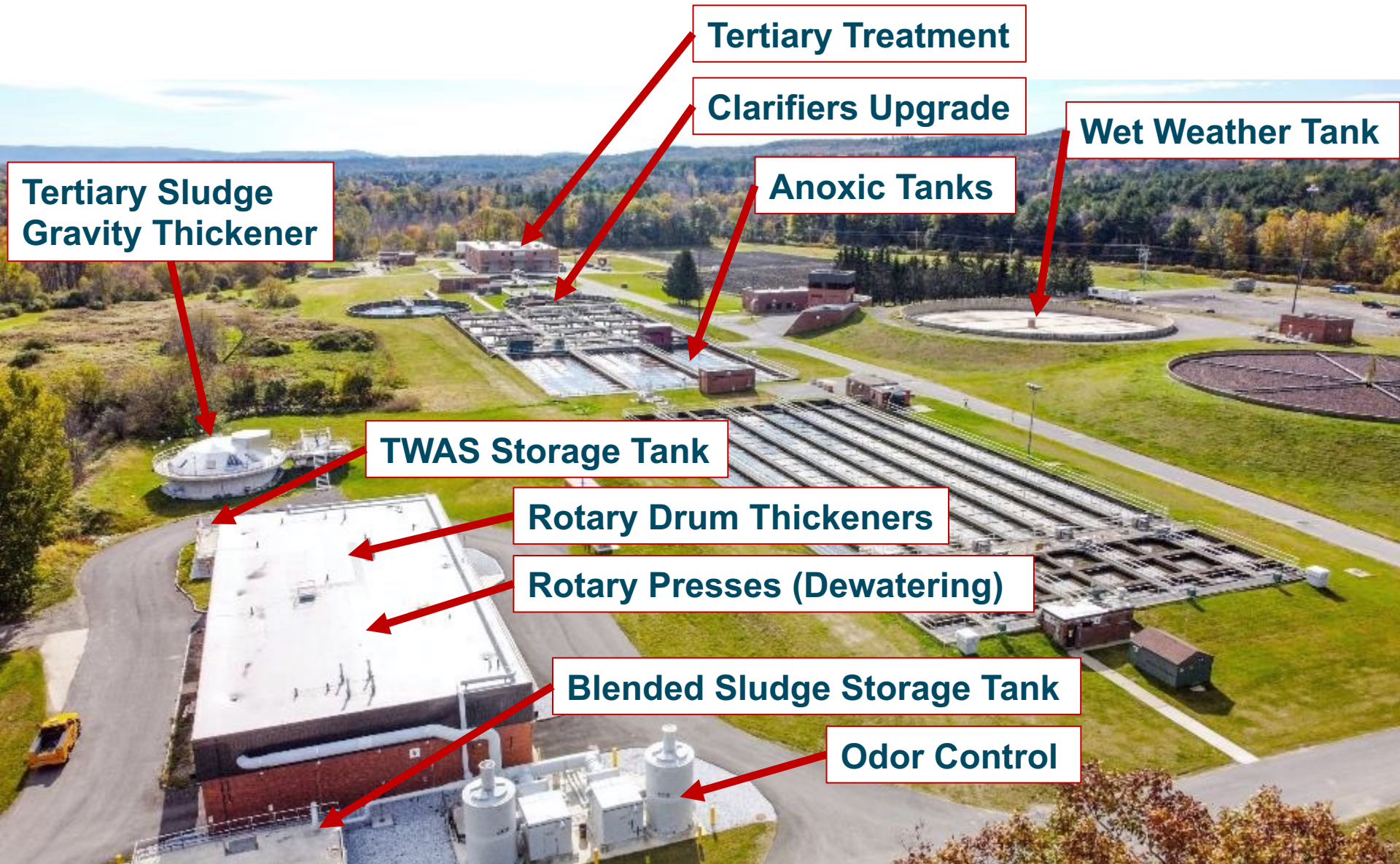


# Project Components

# CoMag Process Flow Diagram



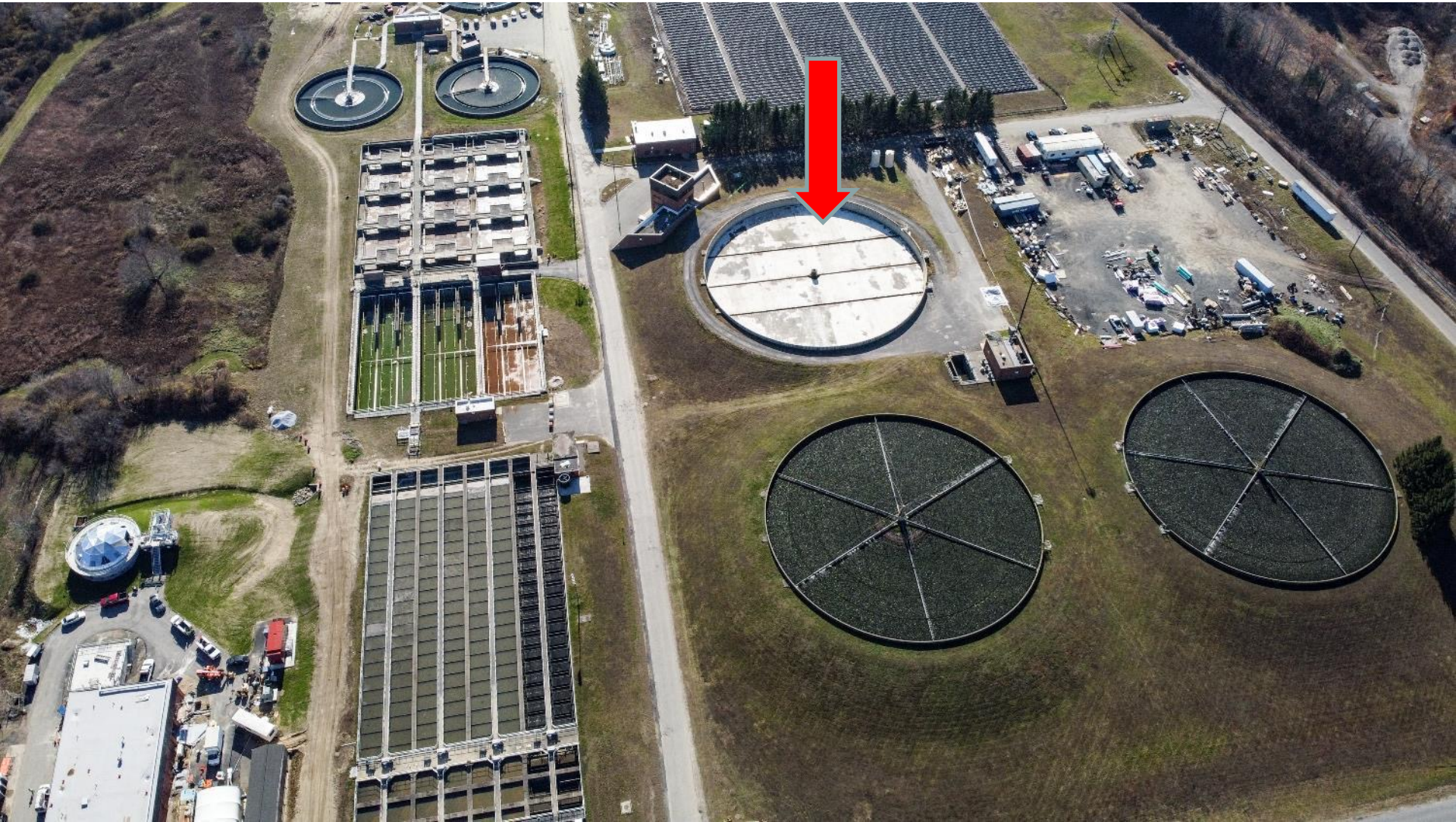
# Nutrient Upgrade



# Anoxic Tanks w/ Compressed Air Mixing



# Wet Weather Tank





# Secondary Clarifier Upgrade



# Secondary Clarifiers Upgrade



# Sludge Processing Upgrade





# CONSTRUCTION

# Project Cost and Schedule

- Total Construction Cost: **\$55.5 Million**
- Construction began March 2019
- Original substantial completion July 2021
- COVID March 2020
- Actual substantial completion October 2021
- Final start-up of tertiary treatment happening NOW

# Selected Construction Details

- Building support piles
- Tertiary clarifiers
- Dust
- COVID



# New Tertiary Treatment Building

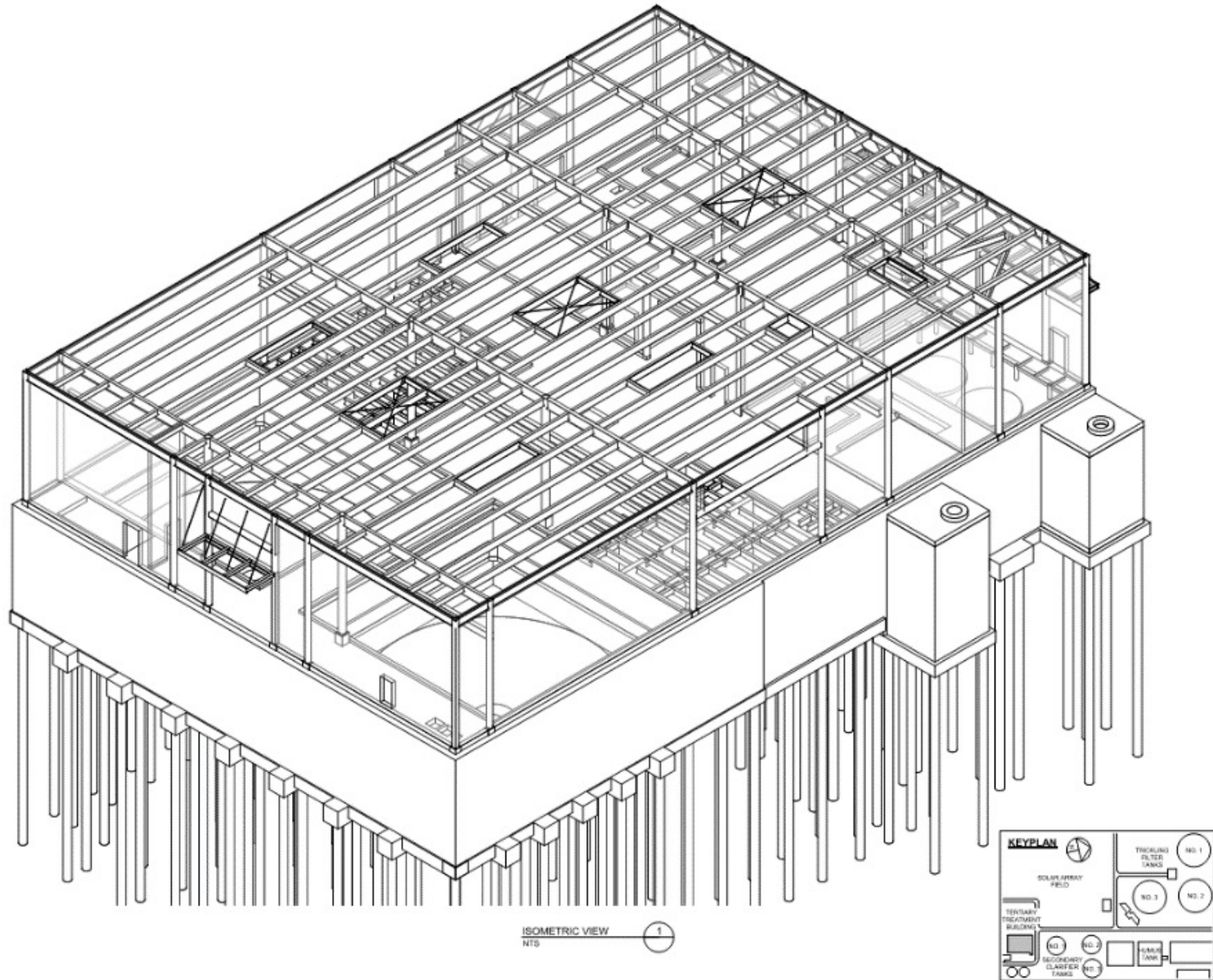


# Sandy Soils



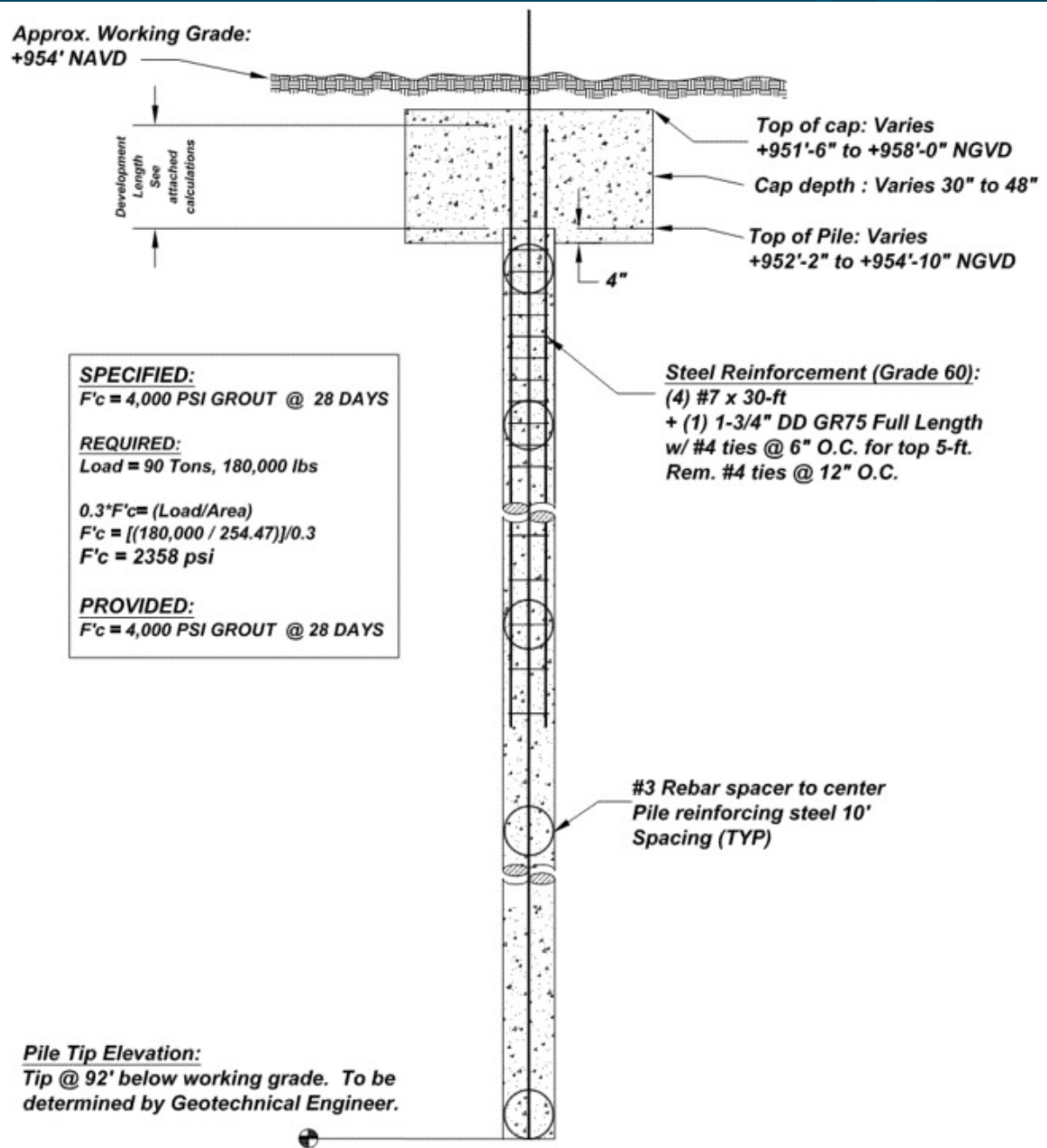


# Building Piles



# Building Piles

- Sandy soil
- Auger cast piles
- 245 piles
- 92 feet deep



# Piles



# Piles Installation





# Placing Rebar



# Tertiary Building



# Tertiary Building





# Tertiary Building Basement



# Tertiary Building

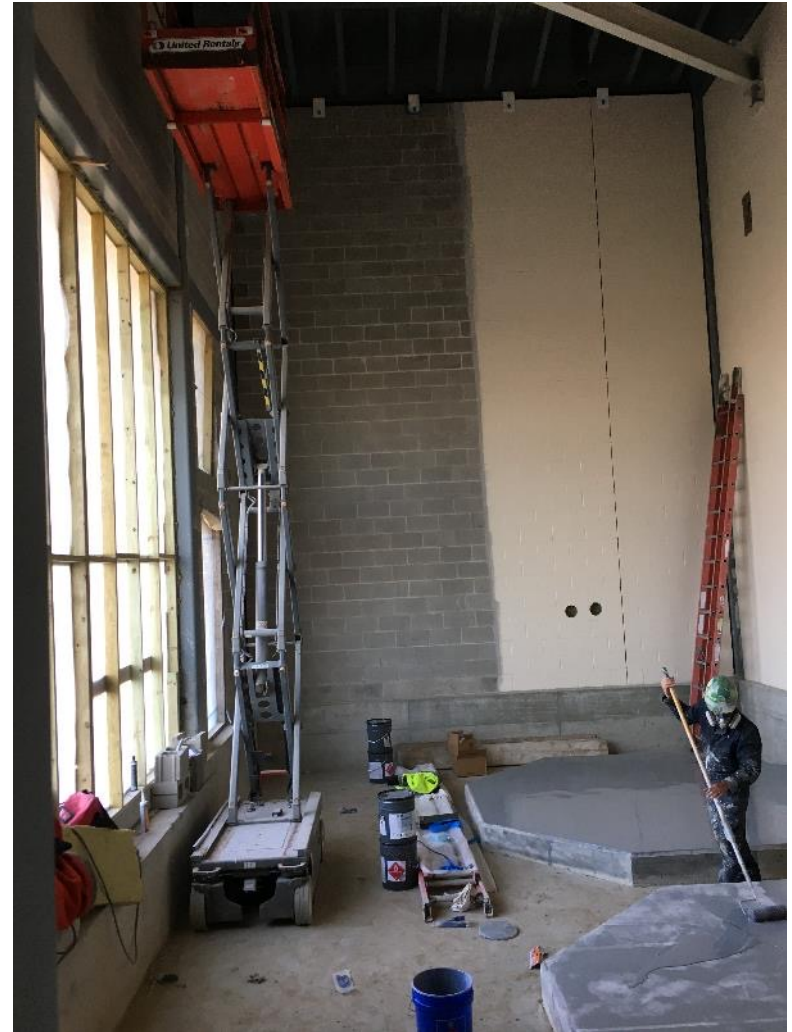


# Process Tank Room

December 2020



# Coagulant Tank Room



December 2020

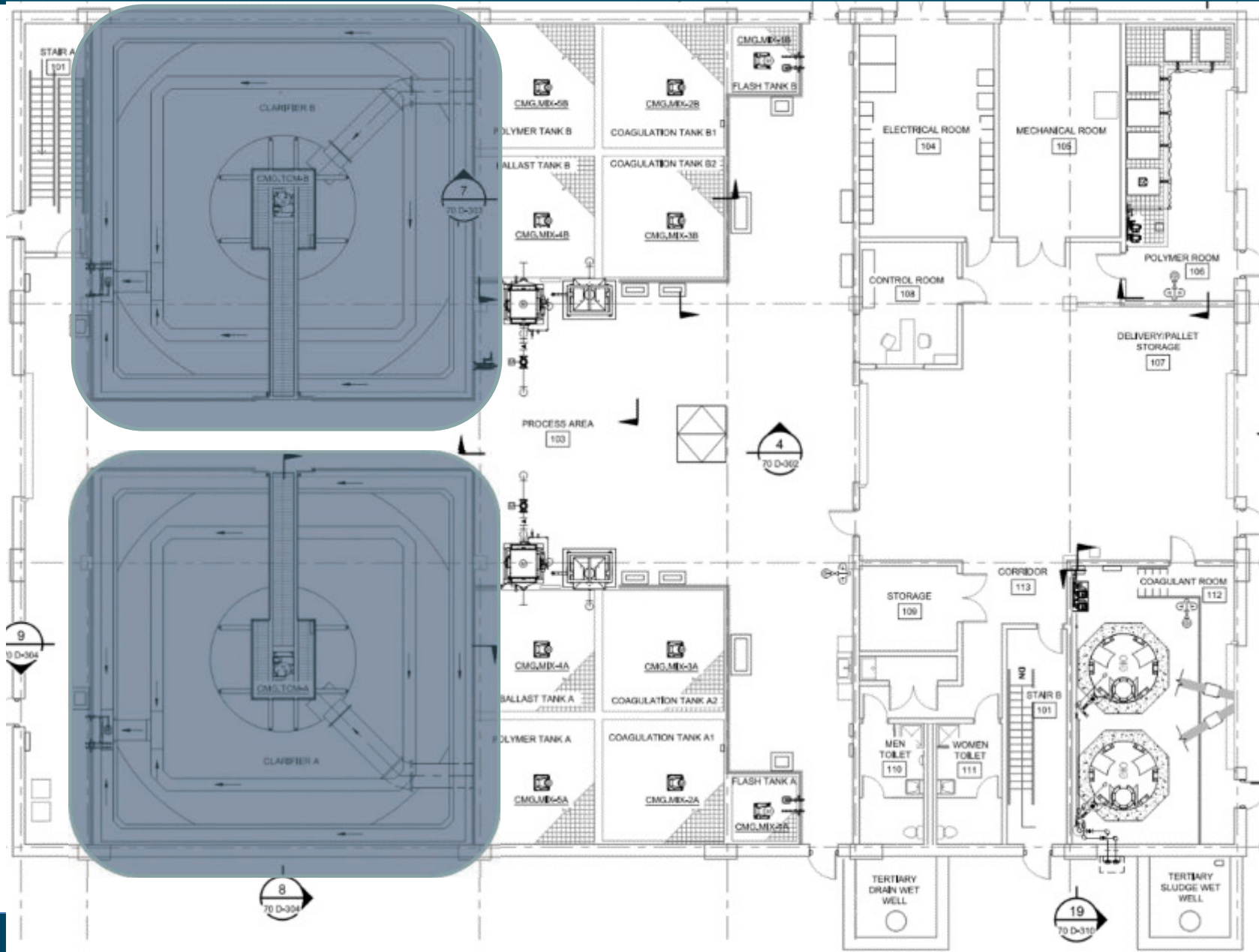
# New Influent Channel



# CoMag System Sludge Pumps



# Tertiary Treatment Building



# Pittsfield CoMag Process Tanks

<b>Tank (One Train)</b>	<b>Dimensions (ft x ft)</b>	<b>Water Depth (ft)</b>	<b>Volume (gal)</b>	<b>HRT (mins) @ Design flow (12.7 MGD)</b>
Flash Tank	8 x 8	12	5745	0.7
Coagulation Tank 1	15 x 15	18	30,294	3.4
Coagulation Tank 2	15 x 15	18	30,294	3.4
Polymer Tank	15 x 15	18	30,294	3.4
Ballast Tank	15 x 15	18	30,294	3.4
Clarifier	45 x 45	14	166,550	18.8
TOTAL			293,470	33.2
TOTAL 2 Trains			586,941	66.3



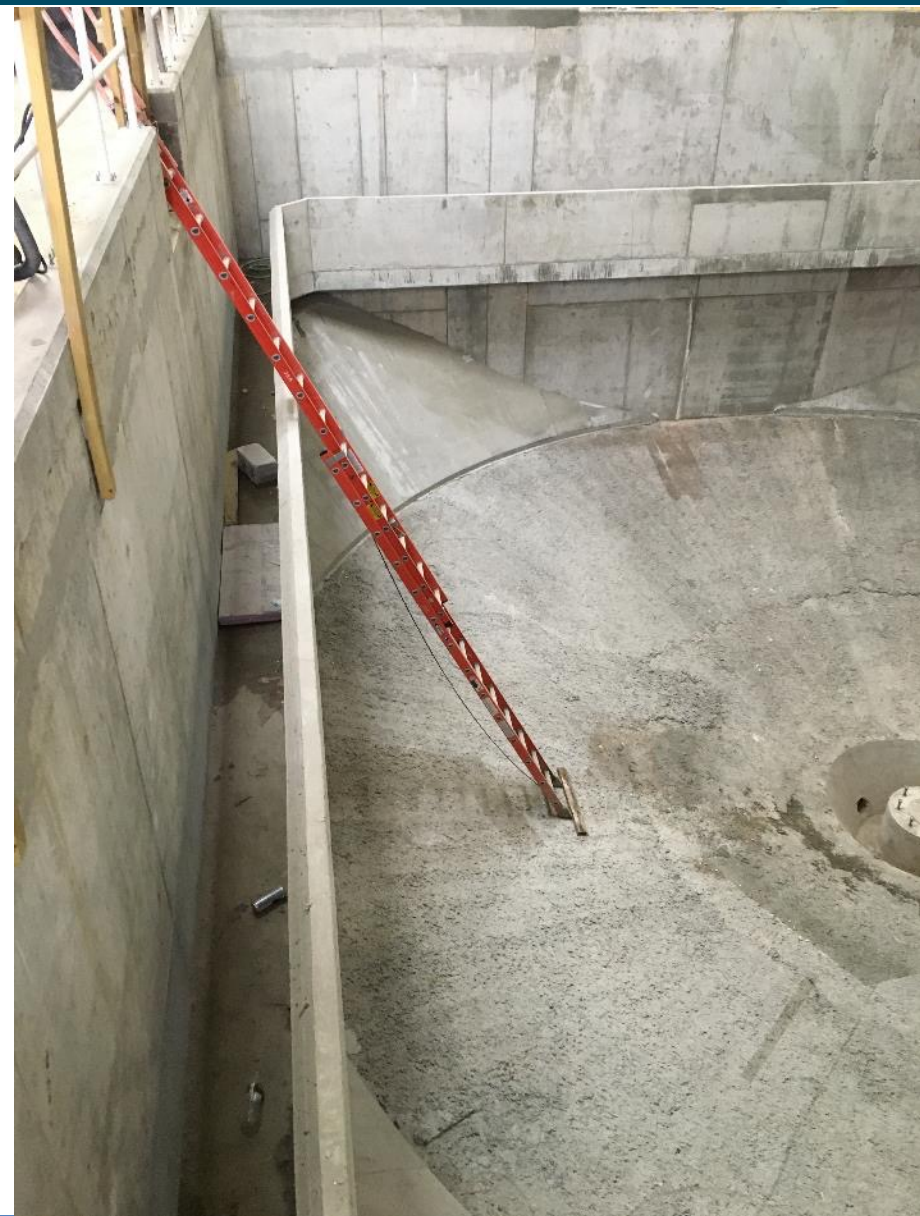
# Tertiary Clarifiers – “Squircles”

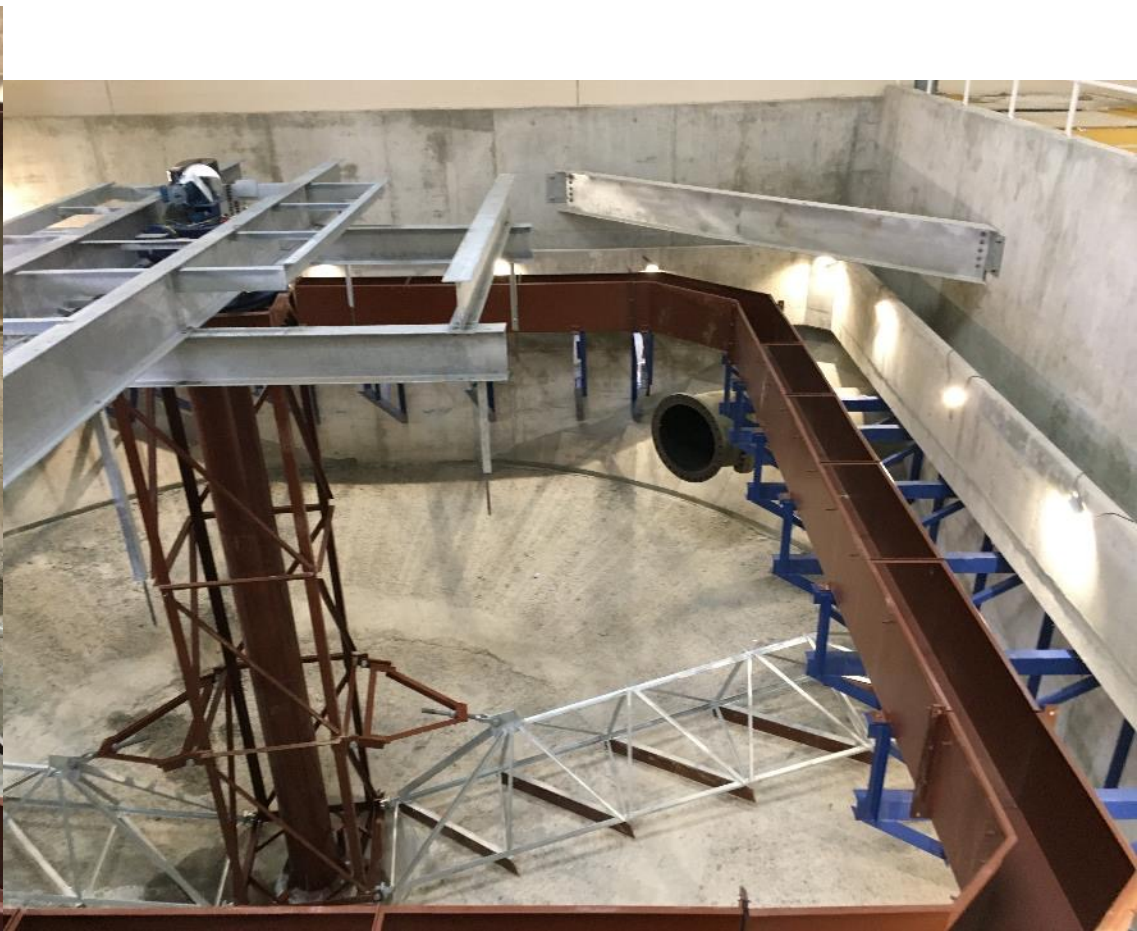
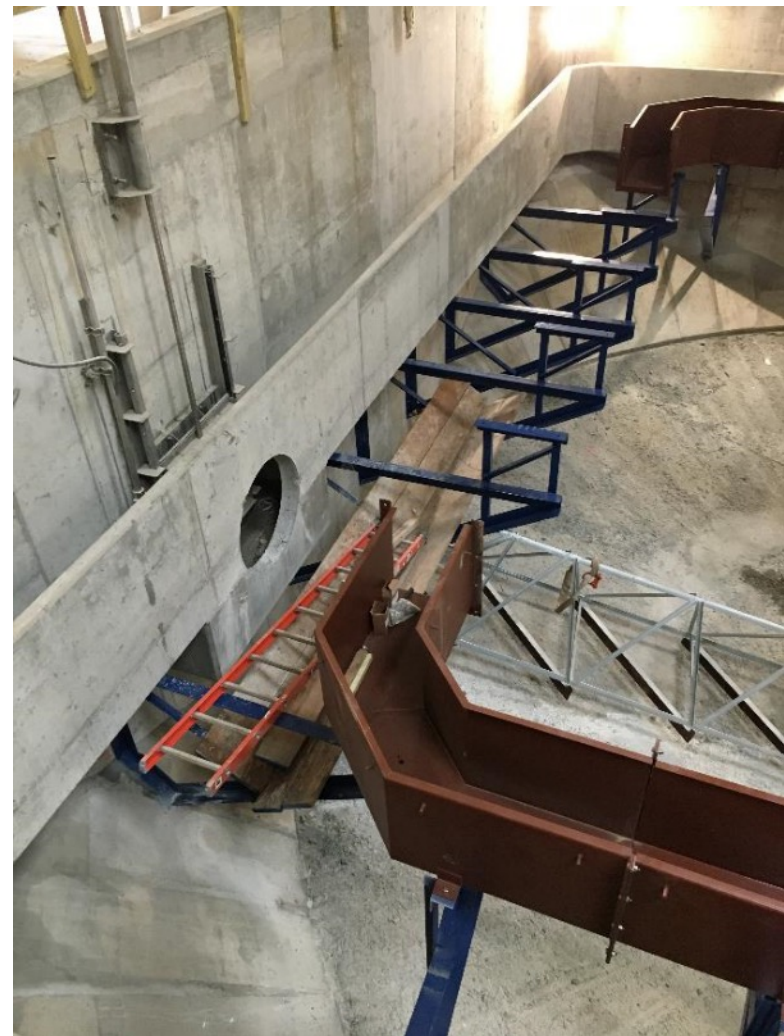






# Tertiary Squircle Clarifiers

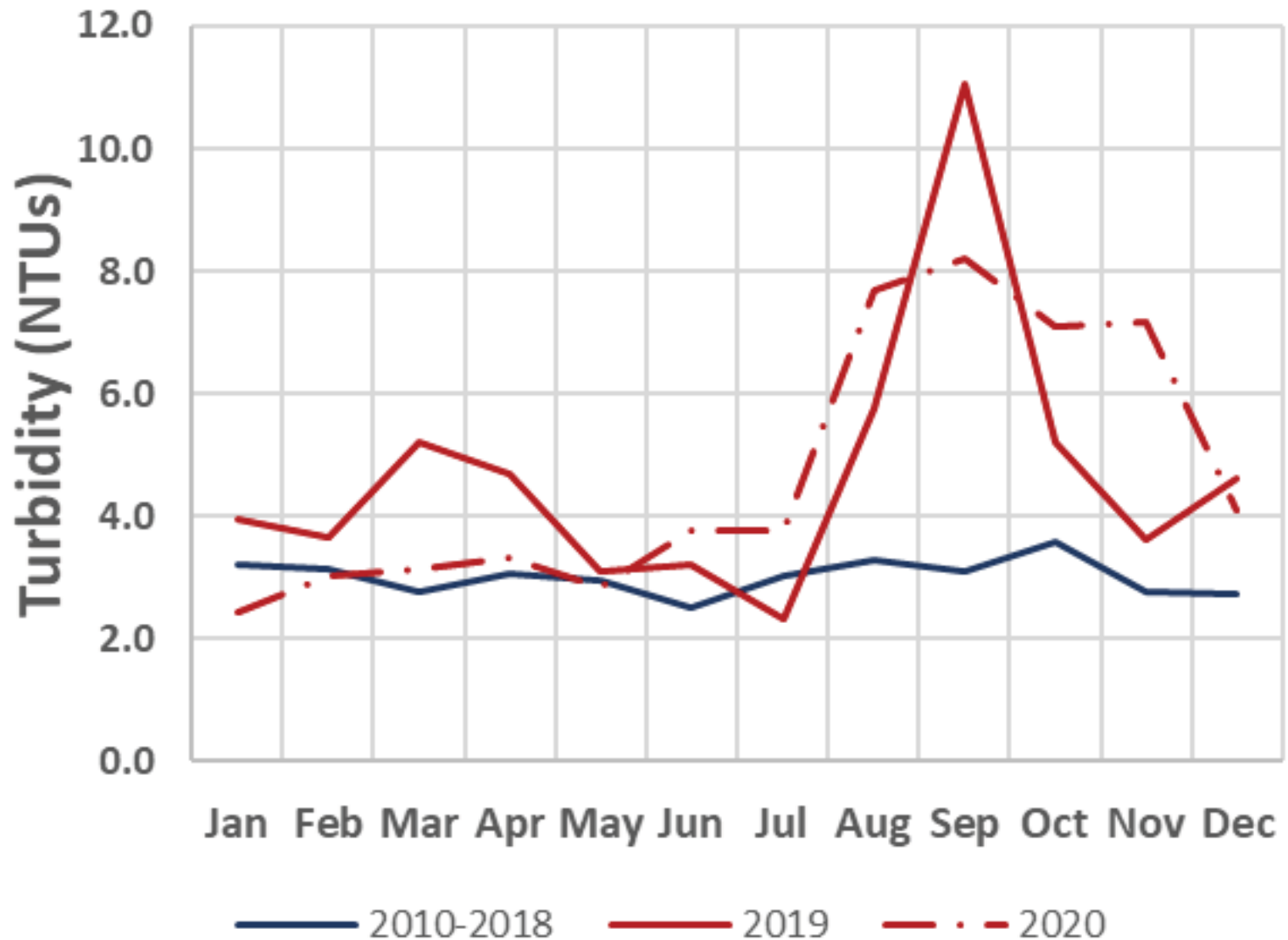








# High Turbidity in Effluent





# Lack of Groundcover



# Dirt



# High Turbidity in Effluent



# Dust Control

- Cover effluent channel
- Sprinklers on dirt piles
- Watering roads
- Limiting traffic on east side of tanks
- Seeding ASAP



# Pittsfield WWTP Post-Construction



# New Tertiary Building



# Process Pumps



Sludge Pumps

Polymer Pumps



# MagDrum & Shear Mixer





# Ballast Feeder



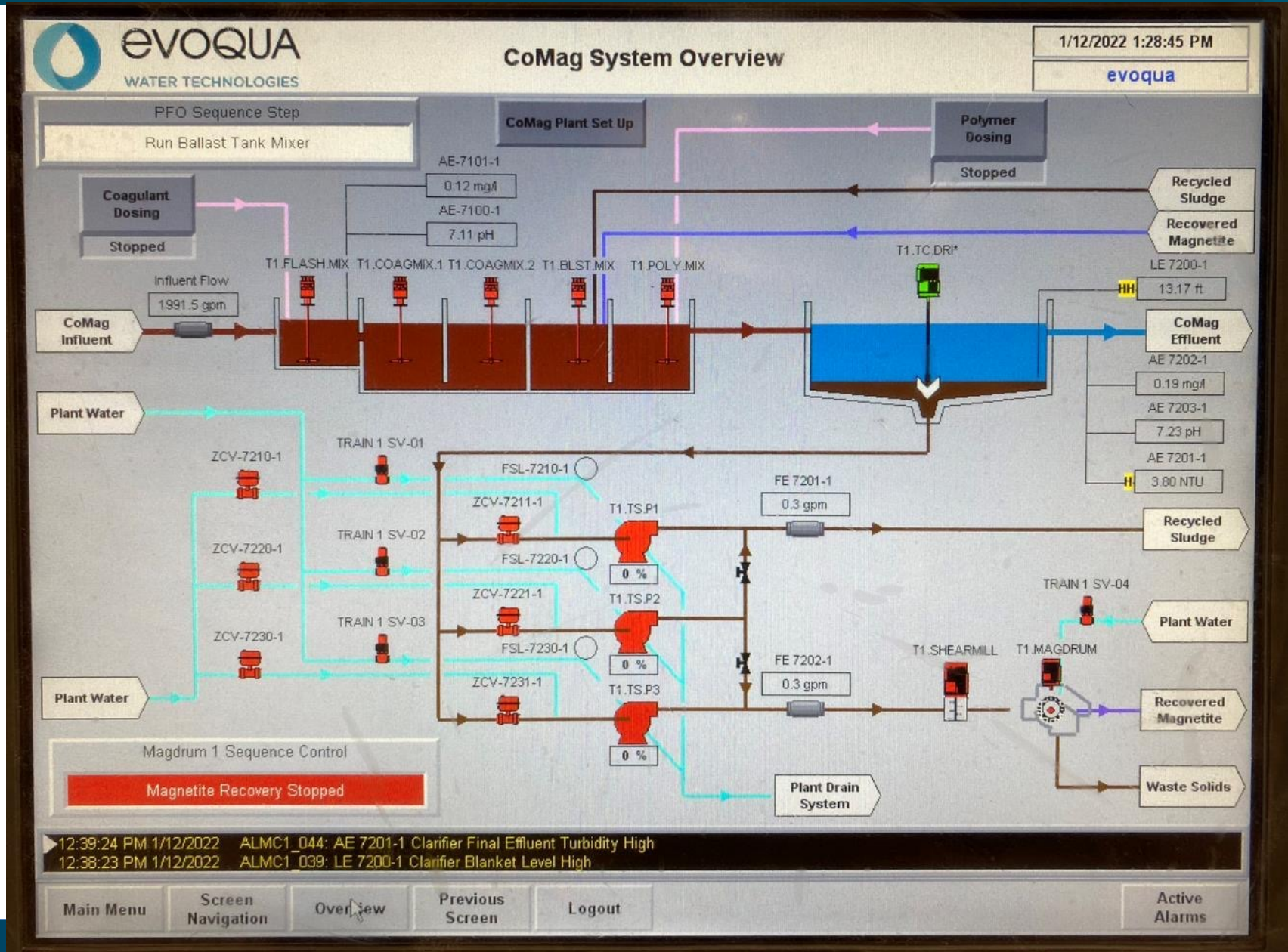
# Magnetite bags – ready for loading



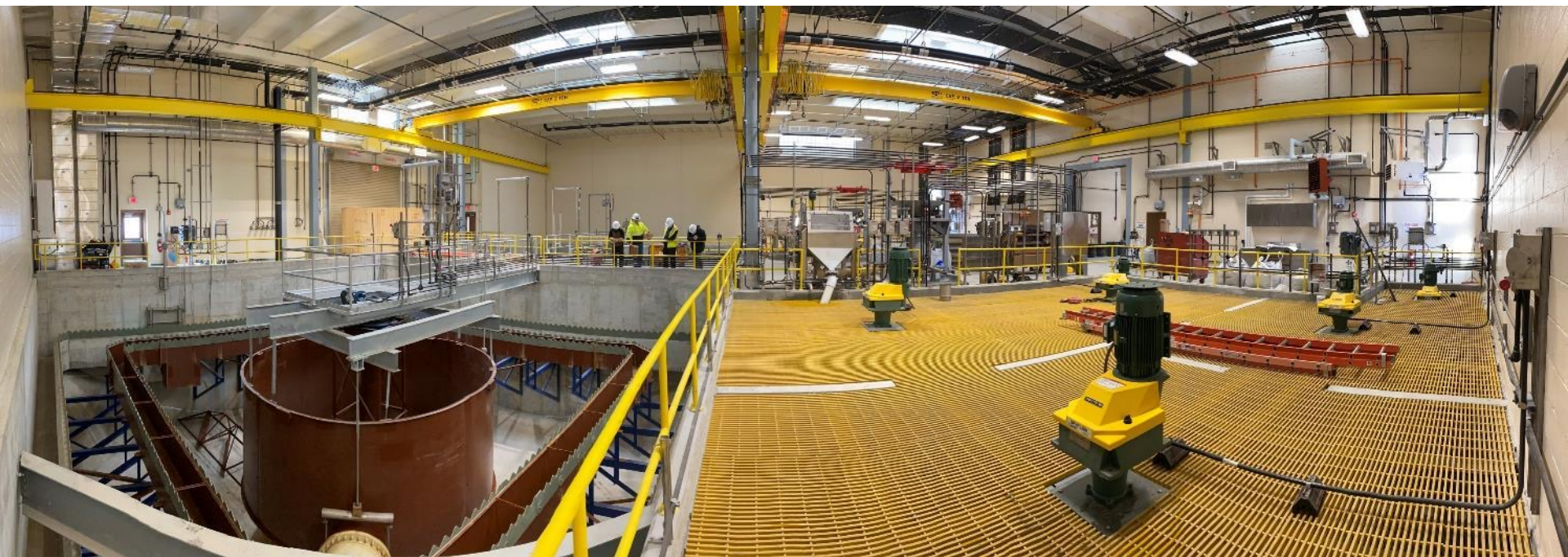
# Process Room



# CoMag Control Panel



# Tertiary Process Tank Room



# New Influent Channel – flow to process



# COVID

- March 2020 shut-downs
  - Reduced staffing schedule for City
- Mask mandates & H&S guidelines (i.e. gloves)
  - friction between contractors and City staff
- Illnesses and quarantines
- Delivery delays
  - Valves, piping, drains, vfd's and other
- Start-up delays





## **Summary / Lessons Learned**



# Summary & Lessons Learned

- CoMag ballasted flocculation for TP & Al removal
- Dewatering and Secondary Treatment
- Dust affected effluent turbidity
- New construction- build in contingency for delays
- Startup is happening Now!
- Process performance, including squircle clarifiers  
TBD
- Contact information for start-up & operational data:
  - [pwestgate@kleinfelder.com](mailto:pwestgate@kleinfelder.com)
  - [jinfantecorona@kleinfelder.com](mailto:jinfantecorona@kleinfelder.com)

# Acknowledgements

- City of Pittsfield
- Carl Shaw, WWTP Superintendent
- Keith Bourassa, WWTP Chief Operator
- Plant Staff
- All of our partners, including AECOM, Wright-Pierce, Methuen & Subcontractors, DEP

# THANK YOU



# ANY QUESTIONS?